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Cover Story

Four Ethernet Transitions: the New Way to Network

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Overview

Ethernet is today's most commonly used LAN technology worldwide. According to International Data Corporation (IDC 2000), more than 85 percent of all LANs are based on the Ethernet. Today's Ethernet technologies are ultimately derived from the specification invented by Dr. Robert Metcalfe and co-developed by Digital, Intel, and Xerox PARC in 1980.

The secret of Ethernet's success is easily explained: over the last two decades, Ethernet standards have continuously advanced to meet evolving network requirements. The original 10-Mbps Ethernet of the early 1980s evolved to 100 Mbps and today's Gigabit Ethernet standards. With the support of the IEEE and the 10 Gigabit Ethernet Alliance, the industry is ready for the next order of magnitude performance improvement.

The rapid growth in Internet Protocol (IP) traffic and the convergence of sophisticated voice, data, and media applications continue to drive the demand for greater network bandwidth, with Ethernet technology providing the foundation for cost-effective, higher performance networking solutions. Intel is driving current deployments of Ethernet in the local area network to gigabit performance. Intel is also investing in the extension of Ethernet to new market segments, including wireless networking, networked storage and Ethernet in metropolitan area network (MAN) environments. (See Figure 1.)

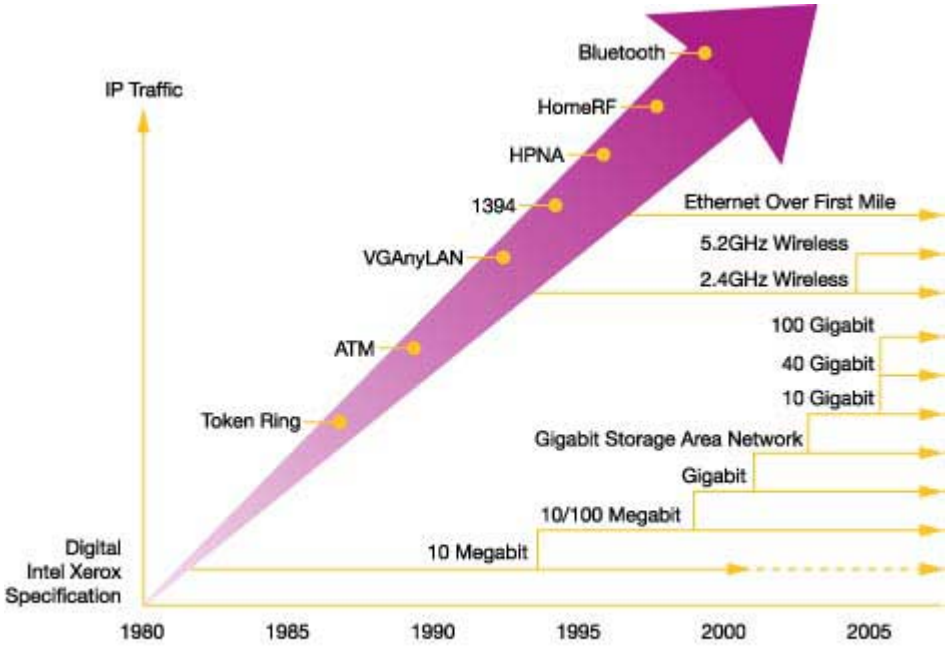

Figure 1. Ethernet Evolution

Networking Transitions

Ethernet has several key attributes that explain why it has become a pervasive technology for IP networking:

- Scalable performance
- Scalable reach to meet a variety of networking applications from short-range LANs (~100 meters) to Metro Area Networks (40+ kilometers)
- Low cost
- Flexibility and interoperability
- Ease of use and administration

Together, these factors make Ethernet an enabling technology in four critical networking transitions.

Gigabit Speeds in the Enterprise

Sophisticated new applications and more powerful PCs are driving demand for Gigabit-enabled desktops:

- The growth of collaborative work environments
- Routine sharing of large data files
- Converged applications
- Increased multitasking, involving multiple applications running simultaneously

Will these applications be sufficient to drive PCs to gigabit performance? What else is required?

Historically, it is instructive to look at the last major Ethernet migration to Fast Ethernet. As applications have grown more bandwidth intensive, and the PC platform offered more processor and bus performance, demand for faster Ethernet LAN connections grew. The demand was fulfilled when Intel deployed a single chip 10/100 Ethernet solution, and offered low-cost NIC and LAN on Motherboard (LOM) solutions compatible with existing IT infrastructure and drivers. This virtuous circle shows clearly that both applications demand and low cost are required for large-scale adoption of faster Ethernet.

Similar dynamics are now driving the adoption of Gigabit Ethernet. Servers are already specified with Gigabit Ethernet for increased performance. At the desktop, Pentium® 4 based clients with PCI-x running Windows* XP are becoming the standard for new purchases and create increased demand on network resources. Shrinking price deltas are ramping the growth of Gigabit. Earlier this year, Intel introduced the first single chip Gigabit Ethernet Solution. This enabled a price point below $100 (US) retail for Intel® PRO 1000 Gigabit Ethernet NICs.

This combination of performance and investment protection for IT has leading OEMs planning to offer Gigabit solutions in key desktop product lines starting now. It is estimated that by the middle of 2002, over 50 percent of worldwide NIC revenues will come from Gigabit Ethernet products (Cahners In-Stat, 2001). PC client developers are also looking ahead and integrating Gigabit LOM solutions in high-performance clients. Given the low cost of gigabit Ethernet and the strong desire for IT managers to future proof their clients, gigabit is rapidly becoming a requirement for the desktop. Over the next year, the majority of desktop clients will offer gigabit Ethernet as the LAN connection.

As clients convert to gigabit Ethernet, infrastructure tends to follow between 12 and 24 months later. We should expect infrastructure to ramp aggressively to gigabit once the majority of clients are gigabit enabled. Following historical trends, this would place an inflection in switch demand sometime in ‘03/’04. High-performance, high-density Ethernet switches and phys will be a key enabler for this transition, and Intel is developing and planning these products now. Switch and router developers need to have this transition on their planning roadmaps now. Are you ready?

As a leading supplier of Ethernet technology, Intel provides a broad range of standards-based, high-performance solutions designed to lower enterprise IT costs and simplify the Gigabit Ethernet transition.

Wireless Networking

Over the past several years, the benefits of wireless networking have become more widely recognized, while wireless devices have become more affordable and available. These factors are making wireless LANs more widely recognized as ideal solutions for mobile users, as well as “instant infrastructure” for a broad range of business customers.

The IEEE 802.11b high-rate standard has been adopted by almost all of today's wireless equipment vendors with data rates up to 11 Mbps. It has emerged as the choice for early adopters in the enterprise, as well as home networking use. The wireless evolution continues today with IEEE 802.11a, which supports faster data rates, longer reach, and more robust security for a new generation of wireless LANs.

802.11a promises significantly higher data rates, up to 54 Mbps, operating at greater range than 802.11b. It is designed to enable enterprise users to perform bandwidth-intensive applications without sacrificing throughput, while improving scalability, interference immunity, and data security. Because 802.11a shares the same Media Access Control (MAC) layer technology as 802.11b, both standards can operate concurrently on the same network. Intel labs are also working with leading standards bodies to address security needs, algorithm development, and spectrum availability at 5.2 GHz worldwide.

Intel offers a broad selection of Ethernet solutions that ease the adoption of wireless Ethernet connectivity while delivering optimum flexibility for new deployments. With the recently announced transition into 802.11a wireless Ethernet products, Intel provides increased performance for the simultaneous use of multiple bandwidth intensive applications with support for more users, greater overall value, and higher levels of security.

The Intel family of 802.11a and 802.11b solutions includes:

- Access points (wireless hubs)
- PC Cards for notebook computers
- PCI adapters for desktop computers
- Mini-PCI embedded solutions for OEM customers
- 802.11a/802.11b dual-mode access points—supports both standards simultaneously to ease the standards transition
- Software designed for simplified setup and easier configuration and management of wired and wireless networks

With its comprehensive line of hardware and software products, Intel offers a wide choice of interoperable wireless Ethernet solutions based on 802.11a and b standards. By building on its expertise in driving wired networking transitions, Intel will extend its Ethernet leadership to provide cost-effective, high-speed connectivity and advanced capabilities for the next generation of wireless networking.

Networked Storage

The rapid growth of e-mail and e-Commerce has combined to produce a dramatic increase in data moving across the public Internet and enterprise IP networks. This increase in data traffic is driving the evolution of data storage outside the traditional direct attached storage (DAS) model and into the infrastructure of the network itself. As a result, the industry is seeing the emergence of storage area networks (SANs) and network-attached storage (NAS) as popular alternatives.

Important storage transitions are now underway, enabled by the emergence of complementary networking and I/O technologies. These trends include:

- The transition to Ethernet and iSCSI technology for Internet Protocol (IP) based storage.
- The emergence of Serial ATA (S-ATA) as a disk interconnect.
- The adoption of InfiniBand* architecture as clustered system interconnect.
- The creation of a new serial bus architecture, Third-Generation I/O (3GIO), as a general purpose I/O interconnect capable of scaling to 10 Gbps and beyond.

An emerging Ethernet-based technology known as iSCSI (Internet SCSI—Small Computer System Interface) provides a high-speed, low-cost, long-distance storage solution for Web sites, service providers, enterprises, and other organizations. Traditional SCSI commands and data transfers are encapsulated in TCP/IP packets. The iSCSI standard makes it possible to build highly interoperable, low-cost IP-based SANs. Some of the challenges that developers face with iSCSI and other implementations are performance, especially TCP/IP offload, storage management and cost.

To enable the transitions to Ethernet-based IP storage, Intel is delivering high-performance, validated storage building blocks based on our core competencies in processing, and Ethernet connectivity:

- Embedded Intel® Architecture processors, chipsets, and Communications Reference Designs that accelerate the time-to-market development of networked storage.
- An iSCSI host bus adapter that enables data sharing over Gigabit Ethernet networks. Earlier this year, Cisco, IBM, and Intel demonstrated iSCSI solutions at Networld + Interop.
- Intel Architecture server platforms and pre-validated RAID-on-motherboard solutions.
- The industry's most advanced storage processor roadmap, including the first Intel product based on the breakthrough performance of Intel® XScale™ microarchitecture.
- Intel® Integrated RAID controllers, reference designs, and RAID management software.
- Comprehensive development tools and software from Intel and a growing list of leading third-party hardware and software vendors.

Intel is using its core competencies to deliver interoperable storage building blocks and products designed to reduce costs and improve time-to-market for equipment manufacturers.

Ethernet in the MAN

The migration to Gigabit Ethernet on the desktop is in turn helping to drive the need for 10 Gigabit Ethernet in servers and enterprise backbones. The emergence of 10 Gigabit Ethernet meets several key requirements for high-speed networks, including lower cost of ownership vs. current alternative technologies, flexibility, and interoperability with existing Ethernet networks. All of these factors make 10 Gigabit Ethernet a natural choice for metro area networking.

OEMs and Service Providers may face deployment issues in the metro network. Do they extend SONET/SDH infrastructure they may already have, or do they deploy a lower cost Ethernet infrastructure? With today's network operators demanding lower cost, and immediate payback on investments, these choices are more difficult than ever. With its expertise in automated, high-volume manufacturing, high-speed and low-power CMOS design capabilities, and opto electronic integration, Intel is uniquely positioned to deliver 10 Gigabit Ethernet solutions with the right combination of price, performance, and density.

Intel currently offers a wide range of standards-based 10 Gigabit components and subsystems, supporting both 10 Gigabit Ethernet and SONET/SDH (Synchronous Optical NETwork/Synchronous Digital Hierarchy) for design flexibility and faster time-to-market. Intel® 10 Gigabit Ethernet products, current and in development, include switching silicon, optical modules, component silicon, MAC devices, adapters, SERDES transceivers, Ethernet storage host bus adapters (HBAs), and Ethernet storage component silicon.

In October, at the European Conference on Optical Communication in Amsterdam, Intel introduced the TNX13303: the industry's first multi-rate transceiver solution that delivers 10 Gigabit Ethernet and OC-192 SONET/SDH communications on a single line card. Intel also announced the world's first complete CMOS Physical Media Device (PMD) for 10 Gigabit Ethernet.

Compatible with existing environments, these cost-effective, flexible, multirate and multi-service solutions accelerate deployment of 10 Gigabit solutions in the MAN.

Summary

One of the oldest networking technologies, Ethernet, continues to evolve into one of the newest, leveraging the proven benefits of cost/performance, flexibility, and interoperability. As the leading supplier of Ethernet components worldwide, Intel is investing in Ethernet as speeds increase and as Ethernet proliferates into new applications. Today, developers have opportunities in four key transitions: Gigabit Ethernet in the enterprise, wireless Ethernet in the enterprise and home, networked storage, and 10 Gigabit Ethernet in MAN environments. As the leader today in Ethernet, Intel is committed to providing the industry with cost-effective, low-power, networking building blocks to support all four major Ethernet transitions.

More Info

For more details about Intel® Ethernet building blocks, visit the Intel® Networking and Communication Products area of the Intel site.

Author Bio

Director of marketing for the Intel Communications Group (ICG), Anthony is responsible for marketing strategies for communication products that enable the industry to transition away from custom low-volume products to a standards-based high-volume modular network.

Anthony joined Intel in 1983. Prior to his current position, he was director of product marketing in the Enterprise Server Group, where he was responsible for Intel® server components including the Intel® Xeon™ and Intel® Itanium™ processors. He also managed Intel's SmartDie® business, and has marketed the i486™, Intel® Pentium®, and Pentium® II processors.

Anthony holds a Bachelor of Science in chemical engineering from Princeton University.

Departments

Desktop

USB: Expanding the Port Count for Desktop Boards

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Overview

Since its introduction in 1995, Universal Serial Bus (USB) technology has enjoyed industry-wide acceptance. The 12-Mbps maximum throughput of USB 1.1 represents a significant improvement over legacy serial and parallel ports. And by eliminating the need to open the PC to add and configure new peripherals, USB's plug-and-play and hot-plug capabilities have made PCs dramatically easier to use.

Most PCs have traditionally featured from two to four USB ports integrated into Intel® chipsets. To add even more ports, developers had the option of adding a USB hub or place an additional USB host controller down on the motherboard. To meet the requirement for additional USB connectivity, the latest Intel® platforms and chipsets support up to seven USB 1.1 ports.

The USB 1.1 specification has now evolved to USB 2.0. Also known as Hi-Speed USB, this evolution of USB technology enhances bandwidth by a factor or 40x to 480 Mbps while preserving backward compatibility with USB 1.1 devices, cables, and connectors. During 2001, vendors have begun to ship USB 2.0 PCI-based add-in cards and PC cards for mobile systems. Peripheral vendors are now shipping products including hard disks and CD-RW and DVD drives that benefit from the increased bandwidth.

Beginning in 2002, PCs will start shipping with at least six USB 2.0 ports integrated into the Intel chipset. These solutions will enable PC manufacturers to cost-effectively build systems capable of connecting to a wide range of high-performance peripherals ranging from video and higher resolution digital cameras to MP3 players, broadband modems, and wireless network interface cards. With its enhanced bandwidth, USB 2.0 will also enable users to connect many more peripherals at one time.

To take advantage of this opportunity, PC manufacturers will need to decide whether to support both USB 2.0 and USB 1.1 ports, how many ports to support, what configuration of ports is available on the front and back panels, and what legacy ports to remove.

Determining the type and number of USB ports can be complicated. This article provides an overview of some of the platform configuration issues. For a detailed comparison of available options, PC manufacturers should read the recently updated white paper available from Intel entitled *Universal Serial Bus (USB): Expanding the Port Count & Bandwidth for Desktop Motherboards into 2003.*

Benefits

From the user's perspective, a Hi-Speed USB 2.0 system will look and act very similar to a system using USB1.1, only with much higher bandwidth. All current USB 1.1 peripherals will work in a USB 2.0-capable PC. USB 2.0 devices will work even when they are plugged into a USB 1.1 port, but this will result in slower performance than when both host and device support USB 2.0

By supporting higher speed data transfers and new peripheral types, USB 2.0 brings outside-the-box hot plug-and-play capability to a new class of peripheral devices. Its aggregate bandwidth of 480 Mbps enables more devices to share the bus at one time.

Design Issues

Removing legacy ports including serial, parallel, and SCSI ports, makes the PC easier to use, simplifies design, increasing form factor flexibility, and has the potential of reducing platform costs.

As the industry eliminates legacy ports, more USB ports will become necessary, including USB 1.1 ports for interface devices and USB 2.0 ports for other peripherals.

At the same time, PC designers need to anticipate how their platforms will support devices that are connected for long periods, such as a high-speed printer or scanner, and devices designed to be frequently plugged in and detached, such as digital cameras. The printer would logically attach to a USB port on the back panel, while the camera would be much easier to use with a front-panel connection.

While adding a USB 2.0 hub is an easy way to increase port count, the devices connected to the hub must share the bandwidth from the host controller. Placing an additional discrete USB 2.0 controller on the motherboard is one alternative that adds both ports and additional bandwidth.

Developers have the option to add a USB controller "up" with a PCI add-in card or "down" on the platform. Adding a controller "down" on the motherboard can help reduce system cost and eliminates the need for users to open the box. These are some of the design issues discussed in detail in the Intel white paper *Universal Serial Bus (USB): Expanding the Port Count & Bandwidth for Desktop Motherboards into 2003.*

Flexible USB

Flexible USB is a design methodology that provides headroom for evolving marketing transitions including the reduction of legacy ports on the PC platform, USB to communications network riser (CNR), and auxiliary internal USB ports that can enable future peripheral migration.

For only a few cents per motherboard, designers can implement flexible USB routing solutions that comprehend these evolving trends. Flexible USB also provides a seamless path for future USB innovation and migration options, while simplifying the number of platform configurations that manufacturers must support.

Flexible USB implementations support USB 1.1 ports only, USB 2.0 ports only, or a combination of both. The aforementioned white paper goes into further detail on these combinations and current Intel platforms that take advantage of Hi-Speed USB 2.0.

Implementations

Intel has released numerous platforms that take advantage of USB1.1 technology. The most recent of these are the Intel® Desktop Boards D845HV and D845WN platforms, each with up to 7 USB1.1 ports.

Intel has also begun to release platforms that take advantage of Hi-Speed USB technology. The Intel Desktop Boards D850MV, D850GB, D845BG have optional discrete Hi-Speed USB technology.

Summary

Because it can help do away with a plethora of legacy serial, parallel, and SCSI ports, Hi-Speed USB will enable PC manufacturers to connect to high-performance peripherals at lower cost. PC manufacturers will be able to simplify their platforms because only USB connectors will be needed for peripheral expansion.

Because USB 2.0 is backward-compatible with existing peripherals, cables, and connectors, today's USB 1.1 devices will work with a USB 2.0 system. The added bandwidth and capabilities of USB 2.0 has the potential to increase the size of the market segment, the number of applications, and the performance capabilities of USB peripherals. Because low-speed peripherals such as the keyboard and mouse do not require the higher bandwidth, they will never need to be redesigned to support version 2.0.

Capturing the momentum of USB 2.0 requires careful planning by PC manufacturers, including a determination of the mix of USB 1.1 and USB 2.0 ports, the number of ports, and the configuration of ports on the front and back panels of the PC. For a detailed look at the available options, readers should read the Intel white paper: *Universal Serial Bus (USB): Expanding the Port Count & Bandwidth for Desktop Motherboards into 2003*.

More Info

The complete Intel white paper, Universal Serial Bus (USB): Expanding the Port Count & Bandwidth for Desktop Motherboards into 2003, is available from the Intel Developer Site.

For a description of Flexible USB and a list of recommended configurations, visit the Desktop Boards area of Intel Developer site.

Visit the R&D/technologies area of the Intel Developer site for information on USB 2.0 specifications, including the Enhanced Host Controller Interface (EHCI) specification and the USB 2.0 Transceiver Macrocell Interface specification.

Announcements and technical data about the USB 2.0 specification are available from the USB Implementers Forum.

Author Bio

Scott E. Francis is a member of the Intel Sales and Marketing Rotational Program. In his current assignment with Intel Desktop Platform Solutions, Scott is responsible for evangelizing future desktop technologies, including USB 2.0. He is a graduate of the University of Illinois at Urbana-Champaign.

Servers

ISVs and xSPs Build Success on IBM Program and IA-based Servers

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Overview

Independent software vendors and service providers of virtually all kinds can now take advantage of xSP Prime, a program offered by IBM and powered by IBM eServer servers based on Intel® Architecture. Since its inception in late 1999 xSP Prime has provided education and tools to more than 300 businesses seeking to take advantage—or take better advantage—of the market for Internet-based software and services, a market expected to reach $460 billion by 2005. In this program, specialists from IBM provide comprehensive instruction and support to developers from ISVs and xSPs with the focus on launching or expanding their respective businesses in the hosted Internet environment.

ISVs: Getting to Know a New Distribution Model

For ISVs, the goal of xSP Prime is to successfully migrate applications and services to an ASP model in a hardware environment of IBM sServer xSeries* servers based on Intel Architecture. To achieve this goal, participants spend one or more weeks at any of 10 xSP Prime solution centers worldwide in activities organized as follows:

Education. In the classroom and in one-to-one coaching, ISVs learn everything from the basics of a hosted application model—including capacity planning, liability, and security issues—to Service Level Agreements and business continuity services. Consulting on these topics is available to xSP Prime participants both during and after their engagement in the program.

Assessment. ISVs learn whether an application is “ASP ready” and, if not, what they can do to make it so. This comes through rigorous, multiple-scenario stress testing and validation for stability, performance, scalability, availability, load balancing, and reliability.

Hosting. ISVs learn of external hosting opportunities and are connected with compatible hosting business partners. ISVs also learn how to implement internal hosting.

Launch. At the end of the xSP Prime program, ISVs are assisted with the launch of their ASP service and are certified with an xSP Prime logo. This certification assures customers that the ISV’s solution is thoroughly tested and validated for distribution in an ASP environment.

xSPs: Building on Success

For xSPs—including application service providers, Web hosting service providers, managed service providers, storage service providers, and Internet data centers—the goal of xSP Prime is to fine-tune a business model for boosting market share, revenue, and profitability.

Financial modeling. In workshops lasting 1–2 days, business and financial consultants provide xSPs with financial modeling tools and instruction for validating a given business plan against industry benchmarks, analyzing it, and determining ways it could be enhanced for profitability.

Technical strategy. In other workshops, highly skilled technical consultants help xSPs to focus on formulating or upgrading technical strategy toward reducing infrastructure costs and applying appropriate technologies to achieve competitive advantage. This consulting is available to xSP Prime participants both during and after their engagement in the program.

Online support. Still another xSP Prime program component is xSP Prime Online. This Web site provides xSPs access to marketing and sales support, discounts, partnership opportunities, and software for training and demonstrations.

Summary

ISVs and xSPs worldwide are taking advantage of education, technology, and enablement assistance offered by xSP Prime, a program offered by IBM and powered by IBM eServer servers based on the Intel Architecture. Through xSP Prime, successful ISVs are expanding their market reach, enhancing distribution opportunities, and offering their customers a dramatic reduction in support, administration, and maintenance costs. For their part, successful xSPs are using the program to learn how sophisticated financial modeling tools can help them make their business and technical strategy even more effective. All ISVs and xSPs that complete the xSP Prime program receive a certification that includes a listing in the IBM xSP Prime Solutions Guide.

IBM xSP Prime solution centers are currently operating in Massachusetts, Minnesota, Oregon, and California in the United States and in England, France, Germany, Korea, Japan, and Australia.

More Info

More information about the xSP Prime program on Intel Architecture is available from the xSP Prime area of IBM's developer site and from the Solution Provider Center area in the Reseller/Provider section of the Intel site.

Author Bio

Marion Koehler is the xSP Prime program manager at Intel. Prior to joining the Solutions Marketing Development Group in May 2001, she has worked in various management capacities within Intel's Worldwide Press Relations. Marion has been with Intel for 15 years, and she holds a B.S. degree from the University of Wisconsin.

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